

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
16 June 2005 (16.06.2005)

PCT

(10) International Publication Number
WO 2005/054956 A3

(51) International Patent Classification⁷: **G03F 7/20**,
G02B 13/14

EPPLE, Alexander [DE/DE]; Langertstrasse 38, 73431
Aalen (DE).

(21) International Application Number:
PCT/EP2004/013519

(74) Agents: **SCHORR, Frank et al.**; Augustenstrasse 46,
80333 München (DE).

(22) International Filing Date:
25 November 2004 (25.11.2004)

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,
MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG,
PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,
ZW.

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/526,096 2 December 2003 (02.12.2003) US

(71) Applicant (for all designated States except US): **CARL
ZEISS SMT AG** [DE/DE]; Carl-Zeiss-Strasse 22, 73447
Oberkochen (DE).

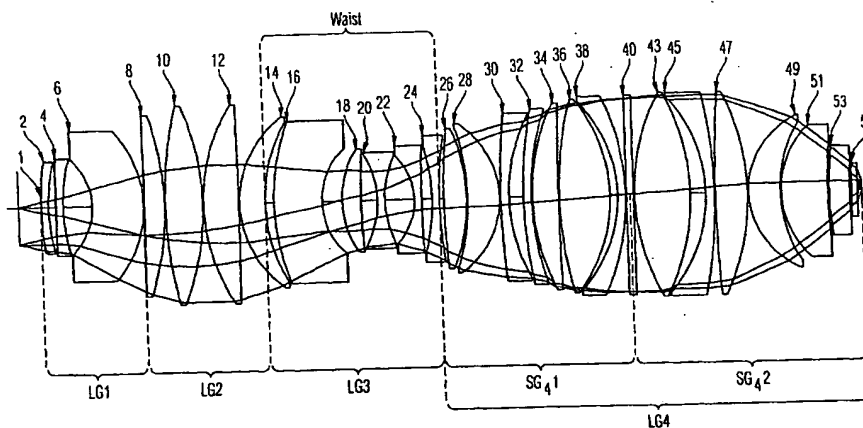
(72) Inventors; and

(75) Inventors/Applicants (for US only): **ROSTALSKI,**
Hans-Jürgen [DE/DE]; Dietrich Bonhoeffer Strasse 9,
73447 Oberkochen (DE). **DODOC, Aurelian** [RO/DE];
Hainbuchenweg 7, 73447 Oberkochen (DE). **ULRICH,**
Wilhelm [DE/DE]; Lederackerring 44, 73434 Aalen (DE).

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,
FR, GB, GR, HU, IE, IS, IT, LU, MC, NL, PL, PT, RO, SE,
SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: PROJECTION OPTICAL SYSTEM



$$2 \cdot \gamma \cdot NA \cdot \frac{1}{k} \cdot \sum_{i=1}^k |p_i| \geq v_1 \quad (1)$$

(57) Abstract: A projection optical system comprises a plurality of lenses disposed along an optical axis of the projection optical system; wherein the plurality of lenses is dividable into four non-overlapping groups of lenses of positive and negative refractive powers, wherein the following relation (1) is fulfilled: (1) wherein: γ is half a diameter in mm of a maximum image field imaged by the projection optical system, NA is a maximum numerical aperture on a side of the second object, p_i is a refractive power in mm⁻¹ of the i^{th} lens, k is a total number of lenses of the projection optical system, and wherein V_1 is greater than 0.045.

WO 2005/054956 A3



Declaration under Rule 4.17:

- of inventorship (Rule 4.17(iv)) for US only

Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(88) Date of publication of the international search report:
24 November 2005